

Remarks

This amendment responds to the Office Action mailed July 13, 2005. Claim 1 is amended; however, no new matter is introduced. Accordingly, claims 1-7 are pending for reconsideration.

Priority

Applicants respectfully renew their request for acknowledgment of the claim for foreign priority under 35 U.S.C. § 119 and the associated filing of a certified copy of Korean Patent Application No. 10-2003-0034843. A certified copy of this Korean patent application, along with a claim for priority, were filed in the United States Patent and Trademark Office on December 8, 2003 in accordance with the requirements of 35 U.S.C. §119(b). Another copy of the foreign priority claim is attached hereto as an Appendix for the Examiner's convenience. Accordingly, acknowledgment of receipt of such claim for foreign priority and associated filing of a certified copy is respectfully requested in the next office communication.

Rejections Under 35 U.S.C. §102

Claims 1-4 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,251,774 to Harada et al. ("Harada" hereafter). Claims 1-4 also stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. 2002/0192945 to Nagahara ("Nagahara" hereafter). Claims 1-5 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,642,153 to Chang et al. ("Chang" hereafter). Applicants respectfully traverse these rejections for at least the following reasons.

Claim 1 has been amended to clarify the invention, reciting that the step of forming a photoresist film on the entire surface refers to forming the layer on "the exposed lower metal line, the via contact hole, and the remaining antireflection film." Further, claim 1 is amended to clarify that the photoresist film patten fills a bottom portion of the via contact hole "to cover the exposed lower metal line."

These amendments emphasize a significant difference that exists between the references cited by the Examiner and the method recited in claim 1. Specifically, in each of Harada, Nagahara and Chang, a stop etch layer is applied to the layer over the metal line, and then in the

process for forming a via, this stop etch layer is not removed before a photoresist layer is applied. Instead, the stop etch layer is not removed to expose the metal line until a final etching step which occurs after the upper metal line trench has been formed. For example, the stop etch layer 34 in Harada is present on the metal line when the via is filled with photoresist in Fig. 4C-4E, and is not fully removed to expose the metal line until the last etching step shown in Fig. 4F. Similarly, in Nagahara, the stop etch layer 7 is left intact on the metal line until the last etching step illustrated in Fig. 3B and 7C. Similarly, Chang shows that the stop etch layer 22A is maintained on the metal line until after the trench is formed (Fig. 2E), and not removed until the final etch (Fig. 2F). This is also shown in Wang, where the stop etch layer 22 is not removed to expose the metal line until after the upper metal line trench has been formed (see Fig. 12). Thus, the cited references disclose the same thing that is described in the Background section of the present invention and illustrated in Fig. 1a-1e. For this reason, the processes disclosed in the cited references are subject to the same drawbacks as those described in the Background, namely rounding of the shoulders of the via and upper trench (shown as points A in Fig. 1e in the present application) due to the need for a final etch to expose the lower metal line. This phenomena of rounded shoulders is even illustrated in the figures of Change (Fig. 2F).

In contrast to the cited references and to the description of the prior art in the Background section of the present application, claim 1 recites as a fourth step “removing the exposed portion of the first etch barrier film to expose the lower metal line.” This is clearly shown in Fig. 3b. This step of exposing the metal line is followed by applying a photoresist to the exposed metal line (not to the stop etch layer as in the cited references). This step of forming the photoresist on the exposed metal line (versus to an etch stop layer as disclosed in the cited references) has been clarified by the foregoing amendment which specifically recites that the photoresist is formed on “the exposed lower metal line.” With the lower metal line exposed except for the photoresist layer, the upper metal line trench can be formed and then the photoresist layer removed to yield a square shouldered via and upper metal line trench (points C in Fig. 3E). This is because a final etch is not required to expose the metal line, and thus there is no etching step that will round the shoulders at points C in Fig. 3E.

In sum, the cited references do not recite the method recited in claim 1. The cited references teach away from the method recited in claim 1 by teaching that the stop etch layer should remain in intact during formation of the upper trench line, thus requiring a final etch to expose the metal line. Accordingly, the Applicants maintain that claim 1 is allowable over the cited references and withdrawal of the rejections under 35 U.S.C. §102(b) and (e) are respectfully requested.

Since claims 2-5 depend from claim 1 which Applicants maintain is allowable, withdrawal of the rejections of claims 2-5 under 35 U.S.C. §102(b) and (e) are also respectfully requested.

Rejections Under 35 U.S.C. §103

Claims 5-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Harada in view of Chang, further in view of U.S. Patent No. 6,521,524 to Wang ("Wang" hereafter), and as being unpatentable over Nagahara in view of Chang, further in view of Wang. Claims 6 and 7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Chang in view of Wang.

Claims 5-7 are dependent upon claim 1 and, accordingly, are believed to be allowable for at least the aforementioned reasons with respect to claim 1. Accordingly, withdrawal of the rejections under 35 U.S.C. §103(a) is respectfully requested.

Conclusion

In view of the foregoing, Applicants respectfully request that a notice of allowance be forthcoming. The Examiner is invited to contact the undersigned for any reason related to the advancement of this case. The Commissioner is authorized to credit any over payment or charge any deficient to deposit account number 08-1641.

Respectfully submitted,
HELLER EHRMAN LLP

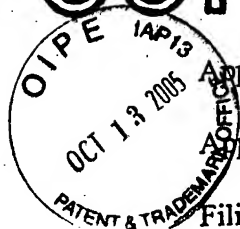
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No.: 40296-0041

Applicant: Yu Chang KIM et al.

Confirmation No.:

Appl. No.: Unassigned

Examiner: Unassigned

Filing Date: December 8, 2003

Art Unit: Unassigned

Title: METHOD FOR MANUFACTURING METAL LINE OF
SEMICONDUCTOR DEVICE

CLAIM FOR CONVENTION PRIORITY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

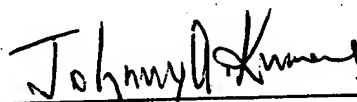
The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested, and the right of priority provided in 35 U.S.C. § 119 is hereby claimed. In support of this claim, filed herewith is a certified copy of said original foreign application:

Korean Patent Application No. 10-2003-0034843 filed May 30, 2003

Respectfully submitted,

Date: December 8, 2003

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